EA GROUP

Environmental Analysis and Management

September 17, 2017

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**General Services Administration**
201 Superior Avenue
Cleveland, Ohio 44114

RE: **Legionnaires Disease Bacteria Level One Investigation**
Anthony J Celebrezze Federal Building, 1240 East 9th Street, Cleveland, Ohio
OH41300

**Description of Work**

EA Group, Mentor, Ohio was contracted by General Services Administration to conduct a Level One investigation to identify potential hazards associated with *Legionella* bacteria contamination of water systems in the Anthony J Celebrezze Federal Building at 1240 East 9th Street in Cleveland, Ohio. Investigation activities included an overview of all water systems in the facility, a walkthrough investigation of water systems, and recommendations for sampling to determine if correction actions are required. Investigation activities were conducted by Certified Industrial Hygienist (CIH) Mark Gradert and EA Group Certified Indoor Environmentalist (CIE) and Industrial Hygienist (IH) Scott Landis between August 15 through 24, 2017.

**Overview of Mechanical Systems**

Facility engineers, Urban Services and others provided original schematic drawings showing typical piping and riser layouts for the building (circa 1963); floor plans for the Sub-Basement through Floor 32; preventative maintenance inspection records for the various mechanical equipment in the building, including but not limited to water systems and air handling equipment; temperature readings from July 2017 for various sinks on Floors 13 to 30; and were available to physically access, inspect and clarify mechanical equipment and operations. The 1963 drawings showed that there were separate risers for cold water, hot water, refrigerated ("chilled") drinking water, and fire protection. However, the various risers, tanks and pump systems shown on the drawings do not represent the current configuration, with many having been abandoned and replaced with more modern or efficient plumbing systems. Currently, there are five water mains serving the building, three for fire protection and two for all other water uses. There are no known connections between the two systems, and the fire protection system is a closed system and thus was not evaluated.

*Water Distribution Systems*

After entering the building through the 6" main in the Basement, domestic cold water is pumped up to six bladder tanks located in the North Penthouse to serve systems associated with the upper floors, or to four bladder tanks located on Floor 16 to serve systems associated with the lower floors. The only other water storage systems include four 570-gallon open atmosphere tanks, two in the North Penthouse and two on Floor 16, and two 2300-gallon feedwater tanks on Floor 31, all of which serve the fan coil units throughout the building. Although the 570-gallon tanks are open atmosphere tanks, they serve a closed loop system so there is no potential for exposure apart from the tanks themselves. There are no openings associated with the 2300-


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gallon tank, thus no potential for exposure. The 2300-gallon tank is associated with the McQuay fan coil units which provide perimeter heating for all floors, with a total of 4600 units.

Hot and cold water is distributed to plumbing fixtures throughout the building, including but not limited to toilets, sinks, drinking fountains and showers. Chilled water is delivered to drinking fountains through drinking water filtration systems on Floor 31 and in the Sub-Basement.

"Dead-legs" in the distribution system include three stubs on each floor in domestic water vertical shafts for future expansion, all of which are capped and expected to be approximately three feet long. In addition, showers and eyewash stations, though flushed weekly, are infrequently used and could be considered dead-legs. Thorough inspection of all water distribution piping was not possible since most is concealed or above the ceiling, which is not considered accessible without special precautions.

*Air Handling Systems*

Main air handling units (AHUs) are located on Floor 31 and in the Sub-Basement. Throughout the building there are also various stand-alone air conditioning units, including Liebert units which serve individual rooms or areas. The potential exposure point for these systems is limited to the condensate pans, which are copper, stainless steel, coated metal or plastic. Most of the larger units have ultraviolet treatment capabilities, and with the exception of the units serving the Coast Guard Command Center on Floor 20, most of the smaller units do not.

McQuay fan coil units are present throughout to provide perimeter heating. These also have plastic condensate pans, but these were not inspected unless we were made aware of known problems. Many of the Liebert and other standalone air conditioning units are located above the ceiling and could not be inspected; some units were at a height requiring a lift to access and were likewise not inspected (Floor 1/Lobby).

Cooling towers are located on the roof, and are comprised of four adjacent towers, each with their own fan, reservoir and louvers. They are not in close proximity to any air intakes or open storage tank systems.

**Walkthrough Investigation**

Following the review of the mechanical systems, a walkthrough of the facility was conducted to inspect all accessible and representative sources and evaluate operating conditions and temperatures.

Sources that were evaluated included cooling towers, open atmosphere storage tanks, bladder tanks, drinking water filtration units, sinks, drinking fountains, hot water tanks and showers. Evaluation of AHUs was limited to the condensate pans, where accessible. A visual inspection of each source was conducted, followed by taking water temperatures under normal operating conditions. Temperatures were taken using a VWR National Institute of Standards and Technology (NIST)-traceable infrared (IR) thermometer. For most stationary sources

(cooling towers, tanks, heat exchangers, etc.) the ambient temperature of the tank or reservoir was recorded. If standing water was present in AHU condensate pans, the ambient temperature of the standing water was recorded. For drinking fountains, first draw and equilibrium temperatures were recorded for cold water only. For sinks and showers, first draw, mid-range and equilibrium temperatures were recorded for hot water systems, and first draw and equilibrium temperatures were recorded for cold water systems. First draw temperatures were taken immediately upon turning on the water, mid-range temperatures for hot water systems were taken after approximately 20 seconds, and equilibrium temperatures were recorded once the maximum/minimum sustained hot or cold water temperature was reached based on a stable IR thermometer reading.

Temperatures for the various sources are shown on Table 1, which also provides the source description, location and floor.

*Cooling Towers*

Temperatures of the water in the four cooling tower reservoirs ranged from 71 ºF to 88 ºF. These temperatures are within the temperature range that can promote the growth of *Legionella* (68 ºF to 122 ºF), but below those considered to be optimal (95 ºF to 115 ºF). At the time of the investigation, there was visible algal growth and surface scum/frothing on the surface of the basins, and the exteriors were dirty. However, the cleaning of the units has since been completed and procedures provided are in accordance with industry practice. Routine maintenance records from Hydro-Chem Corp. were provided for review for May, June and July 2017. Records do not differentiate between the four reservoirs, and are assumed to be representative of all four. The records show that various steps were taken to adjust chemical levels in the towers and loop systems, and the reservoirs and other systems had been drained to bled off to remove debris and to control the buildup of dissolved substances. Additional information provided by Hydro-Chem and/or RelMec indicated that hypochlorite bleach with inhibitors is added to supplement the other two biocides used, one of which is liquid and the other solid tablets. Based on the information provided, the towers are cleaned annually.

*Storage Tanks, Bladder Tanks, Heat Exchangers and Hot Water Tanks*

Open atmosphere storage tanks for the heat coil unit systems, and the ten bladder tanks for domestic water use (North Penthouse and Floor 16) have temperatures between 73.1 ºF and 76.4 ºF. There were no operational issues associated with any of these tanks.

Remaining tanks in the North Penthouse, Floor 32, Floor 16 and Sub-Basement are abandoned. Evidence of standing water was present in some, but these are completely isolated from operating systems. One in North Penthouse had no evidence of water as the bottom drain was in an open position, and the system is valved off of the remaining system.

Steam to water heat exchangers which are considered "insta-heat" systems and provide hot water distribution, were set to 130 ºF. However, although they were set at 130 ºF, measured temperatures were at 134.1 ºF. Heat exchangers HX-08-A through HX-08-C replaced H-1-2 in the Sub-Basement. Gauges are present to monitor temperatures, but were not working, as was the case for the water to water exchangers and Alpha Laval plate exchangers in the Sub-Basement.

The tenant-owned hot water tank located in Room 2693C on Floor 26 had a temperature of 108 ºF at the drain, below the recommended 140 ºF. The hot water tank (T-1-3) in the Sub-Basement had no drain valve, so no temperatures were able to be taken. This tank serves the hot water for the kitchen and childcare centers.

*Drinking Water Systems*

The Filtrine drinking water filtration systems are located on Floor 31 and in the Sub-Basement. Both have UV sterilization systems, but it was not operating for the unit on Floor 31. The operating temperature for the unit on Floor 31 was set for and confirmed to be 50 ºF, and for the unit in the Sub-Basement was set for and confirmed to be 40 ºF.

The drinking fountains receive chilled water from the Filtrine systems. Of the 118 drinking fountains evaluated, 55 had initial flow temperatures above 68 ºF. The vast majority of drinking fountains had equilibrium temperatures close to the Filtrine system setting. Only one drinking fountain had an equilibrium temperature above 68 ºF (Floor 19, Corridor SW).

The ice machine in the Kitchen in the Basement is essentially a closed system and the incoming water source is not readily accessible for investigation or sampling.

*Sinks*

A total of 129 sinks throughout the building were evaluated. Nearly all sinks in the restrooms have a common hot/cold faucet, with mixing valves. Cold water temperatures upon initial flow for all sinks were above 68 ºF. Equilibrium cold water temperatures for all sinks were also above 68 ºF, with some evidence that some of the mixing valves may not be working properly given the higher cold water temperatures, particularly for those on Floors 19, 20 and 21. Hot water temperatures upon initial flow ranged from 67.2 ºF to 118.5 ºF. Temperatures after approximately 20 seconds ranged from 63.3 ºF to 129.4 ºF. Only two of these were above 122 ºF. Equilibrium hot water temperatures ranged from 73.1 ºF to 131 ºF, with 16 of the 127 being above 122 ºF.

Slop sinks are located throughout the building. Since they are not used regularly, water temperatures were not evaluated.

*Showers and Eye Wash Stations*

Three showers were identified in the building, with separate Men's and Women's showers in the Sub-Basement, and a unisex shower on Floor 20. Hot water temperatures upon initial flow ranged from 67.9 ºF to 73.7 ºF, after 30 seconds ranged from 95 ºF to 98.3 ºF, and equilibrium temperatures ranging from 104 ºF to 111.5 ºF. Equilibrium temperatures were all below 122 ºF.

Although not observed, eye wash stations are located in mechanical areas and flushed weekly.

*Air Handling Systems*

Where standing water was present in AHU condensate pans, ambient temperatures were recorded. Temperatures ranged from 44.1 ºF to 66 ºF, all below 68 ºF.

Biocide cakes were observed in use for some of the condensate pans, but not all. The UV systems for one AHU (A-11-20 on Floor 31) is not operating.

Most of the air conditioning units associated with computer/server rooms and those in the Coast Guard area on Floor 20 require tools to access or were out of service, and were not inspected.

**Relevant Findings and Recommendations**

Based on the investigations performed, the following relevant findings are presented:

1. The cooling towers may provide a source for *Legionella* bacteria growth, even though the potential exposure to building occupants other than those who work in close proximity is low. The cooling towers are not in the vicinity of any air intake or other pathway to the building interior. Full maintenance of the cooling towers was recently conducted. Once verified, the maintenance of the systems should be structured as dictated by the Wisconsin Protocol as described in the Occupational Safety and Health Administration (OSHA) Technical Manual (Section III, Chapter 7, Part V(B)(5)).
2. Hot water distribution systems should be evaluated, maintaining the hot water temperatures at both the heaters and distal points for sinks and showers. Where temperatures were able to be taken at water heating points they were less than the recommended 140 ºF [Note: Insta-hot systems are designed to be set at 130 ºF]. At distal points, the majority of the equilibrium temperatures were not greater than 122 ºF. Many of the temperatures for both hot and cold water systems were within the range that promotes *Legionella* bacteria growth, with many of the hot water systems being in the range for optimal growth. These conditions can lead to an amplification of *Legionella* bacteria in the system, with an increased *potential* for Legionellosis in compromised individuals if exposure pathways are complete. Potential transmission from these sources are, however, considered low, since most would not be considered significant sources for aerosolization for inhalation. Showers are the exception, since they represent a

high potential for aerosolization when used. Corrective actions should be taken to address temperature deficiencies.

3. Cold water systems for sinks and showers were found to have operating temperatures within the range that can promote *Legionella* growth, although this is true of most cold water systems. Chilled water systems for drinking fountains generally had equilibrium temperatures below this range, but they were within this range during first draw evaluation. This is likely due to water in the immediate vicinity of the outlet coming up to room temperature or being influenced by the operation of the fountain and increasing in temperature. These sources represent a low exposure potential, but no corrective actions appear warranted.
4. AHUs appear to be maintained and do not represent a high risk for potential exposure. The UV systems for those which have the capability should be inspected to ensure they are operating properly. Some were not operating, and others were operating even though alarm systems showed they were not.
5. Mixing valves for sinks should be evaluated, as some do not appear to be operating properly, particularly those on Floors 19, 20 and 21.
6. A number of systems are considered "abandoned". Though they do not appear to represent risks, verification that the systems have been completely isolated and fully drained should be conducted.
7. All systems which have temperature gauges to set and regulate temperatures should be checked, as some do not appear to correlate to actual operating temperatures. This includes, but is not limited to, hot water systems and chilled water filtration systems.
8. There are a minimum number dead-legs identified for the system, although additional may be identified in ceiling plenums. Showers and eye wash stations are used infrequently, and should be considered dead-legs and continue to be flushed weekly.

The information derived from the investigation alone is sufficient to prompt the recommended corrective actions, and confirmation that the corrective actions were effective is also recommended.

The data, information, interpretations, or recommendations contained in EA Group's reports are presented solely as a basis and guide to the existing conditions as evaluated at the project site. Any conclusions or professional opinions presented herein were developed in accordance with generally accepted industrial hygiene principles and practices. As with all industrial hygiene evaluations and reports, any opinions expressed herein are subject to revisions in light of new information that may be developed in the future, and no warranties are expressed or implied.

This report has not been prepared for use by any party other than our Client. It may not contain sufficient information for the purposes of other parties or other uses. If any significant changes are made to site conditions, resident activities, equipment, etc. described in this report, any conclusions or recommendations contained herein may be invalid, unless changes are reviewed by EA Group and conclusions or recommendations are modified or approved in writing.

If there are any questions or concerns regarding the information provided, please contact the undersigned. Thank you for consulting EA Group.

Sincerely,

**EA Group**

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**Temperatures at Domestic Water Sources**
**Legionnaire's Disease Bacteria Level One Investigation - August 2017**
**General Services Administration Anthony J Celebrezze Federal Building**

| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| Roof | CT | Basin 1 | | | | | | 73 |
| Roof | CT | Basin 2 | | | | | | 88 |
| Roof | CT | Basin 3 | | | | | | 71 |
| Roof | CT | Basin 4 | | | | | | 71 |
| Roof | T (T-1-10) | N. Pent. | | | | | | 76.4 |
| Roof | T (T-1-11) | N. Pent. | | | | | | 75.8 |
| Roof | T (Bladder Tank) | N. Pent. | | | | | | 73.1 |
| 31 | AHU (A-11-17) | 31 North | | | | | | 52 |
| 31 | AHU (A-11-18) | 31 North | | | | | | 44.1 |
| 31 | AHU (A-11-20) | 31 South | | | | | | 53 |
| 31 | AHU (A-11-21) | 31 South | | | | | | 50.3 |
| 31 | AHU (A-11-18 Vent) | 31 South | | | | | | 59 |
| 31 | AHU (A-11-20 Vent) | 31 South | | | | | | 52 |
| 31 | AHU (A-11-21 Vent) | 31 South | | | | | | 56.5 |
| 31 | HE (H-1-11/12) | 31 North | | | | | | 134.1 |
| 31 | DWF (W-1-1) | 31 South | | | | | | 50 |
| 31 | S | Men's Rm. (Building Core) | 71.8 | 119 | 122 | 71.8 | 76.1 | |
| 31 | S | Women's Rm. (Building Core) | 73.5 | 75.9 | 106 | 74.3 | 77 | |
| 31 | DF | Corridor | | | | 72.6 | 48.9 | |
| 30 | S | Women's Rm. (Building Core) | 89 | 111.3 | 124 | 74.4 | 72.7 | |
| 30 | S | Men's Rm. (Building Core) | 75.9 | 104.6 | 121.9 | 74.4 | 72.3. | |
| 30 | DF | Corridor NE | | | | 72.5. | 47.5 | |
| 30 | DF | Corridor SE | | | | 69.8 | 46.5 | |
| 30 | DF | Corridor SW | | | | 67.6 | 46.1 | |
| 30 | DF | Corridor NW | | | | 64.1 | 46.1 | |
| 30 | S | 3087M | 87.1 | 112.1 | 116 | 79 | 74.3 | |
| 29 | S | Women's Rm. (Building Core) | 94.5 | 115.4 | 124.6 | 77.2 | 72 | |
| 29 | S | Men's Rm. (Building Core) | 83.8 | 119.6 | 124.9 | 77.2 | 71.3 | |
| 29 | DF | Corridor NW | | | | 52 | 46.3 | |
| 29 | DF | Corridor NE | | | | 70.1 | 48.8 | |

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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 29 | DF | Corridor SE | | | | 55.9. | 48.8 | |
| 29 | DF | Corridor SW | | | | 67.8 | 51.3 | |
| 28 | S | Women's Rm. (Building Core) | 83.3 | 117.1 | 127 | 83.5 | 71.9 | |
| 28 | S | Men's Rm. (Building Core) | 82.3 | 117.4 | 122.6 | 81.6 | 72.8 | |
| 28 | DF | Corridor NW | | | | 70.8 | 52.3 | |
| 28 | DF | Corridor NE | | | | 73.6 | 51.6 | |
| 28 | DF | Corridor SE | | | | 70.9 | 51.2 | |
| 28 | DF | Corridor SW | | | | 69.3 | 50.2 | |
| 27 | S | Women's Rm. (Building Core) | 103.3 | 108.9 | 122.2 | 79.3 | 73.7 | |
| 27 | S | Men's Rm. (Building Core) | 92.3 | 110.1 | 123.5 | 80 | 72.5 | |
| 27 | DF | Corridor NE | | | | 71.1 | 50 | |
| 27 | DF | Corridor NW | | | | 66.9 | 47.9 | |
| 27 | DF | Corridor SW | | | | 72.4 | 48.1 | |
| 27 | DF | Corridor SE | | | | 55.4 | 46.6 | |
| 26 | T (Hot Water Tank) | 2693C | | | | | | 108 |
| 26 | S | Women's Rm. (Building Core) | 87.7 | 110.5 | 123.9 | 77.1 | 73.6 | |
| 26 | S | Men's Rm. (Building Core) | 91.1 | 117.4 | 123.2 | 75.9 | 72.3 | |
| 26 | DF | Corridor NE | | | | 68.8 | 49.8 | |
| 26 | DF | Corridor NW | | | | 53.1 | 47.5 | |
| 26 | DF | Corridor SW | | | | 65.5 | 47.1 | |
| 26 | DF | Corridor SE | | | | 63.8 | 48.5 | |
| 26 | S | 2693B Men's | 70.8 | 70.7 | 104.1 | 69.9 | 70.3 | |
| 26 | S | 2687D | 67.2 | 68.6 | 110.3 | 72.3 | 68.4 | |
| 26 | S | 2693D | 71.8 | 74.8 | 107.6 | 71..8 | 69 | |
| 26 | S | 2693I | 69 | 98.8 | 109.1 | 75.6 | 69.6 | |
| 26 | S | 2693S | 68.4 | 95.4 | 109.4 | 83.2 | 69.3 | |
| 26 | S | 2693L | 71.3 | 71.4 | 102.2 | 75.4 | 69.8 | |
| 25 | S | Women's Rm. (Building Core) | 105.1 | 125.8 | 126.5 | 81 | 72.9 | |
| 25 | S | Men's Rm. (Building Core) | 104.1 | 102.5 | 123.9 | 80.3 | 73.7 | |
| 25 | DF | Corridor NW | | | | 68.4 | 46.3 | |
| 25 | DF | Corridor NE | | | | 66.3 | 46.3 | |

**Temperatures at Domestic Water Sources**
**Legionnaire's Disease Bacteria Level One Investigation - August 2017**
**General Services Administration Anthony J Celebrezze Federal Building**

| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 25 | DF | Corridor SE | | | | 53.1 | 45.6 | |
| 25 | DF | Corridor SW | | | | 51.3 | 44.9 | |
| 24 | AHU (A-7-46 AHU58) | Elev. Equip. Room | | | | | | 53 |
| 24 | S | Women's Rm. (Building Core) | 90.6 | 112.9 | 122 | 73.1 | 70.3 | |
| 24 | S | Men's Rm. (Building Core) | 91.4 | 119.4 | 120.1 | 74.3 | 71.8 | |
| 24 | DF | Corridor NW | | | | 61.9 | 49.5 | |
| 24 | DF | Corridor NE | | | | 58.4 | 48.5 | |
| 24 | DF | Corridor SE | | | | 64.6 | 48.8 | |
| 24 | DF | Corridor SW | | | | 51 | 48.5 | |
| 23 | S | Women's Rm. (Building Core) | 88.1 | 99.6 | 106.6 | 75.6 | 72.4 | |
| 23 | S | Men's Rm. (Building Core) | 83.3 | 94.1 | 102.1 | 74.5 | 71.6 | |
| 23 | DF | Corridor NW | | | | 59.1 | 46.7 | |
| 23 | DF | Corridor NE | | | | 66.3 | 47.9 | |
| 23 | DF | Corridor SE | | | | 66.5 | 47.9 | |
| 23 | DF | Corridor SW | | | | 62.6 | 47.9 | |
| 22 | S | Women's Rm. (Building Core) | 101.1 | 106 | 116 | 74.6 | 72.1 | |
| 22 | S | Men's Rm. (Building Core) | 93.4 | 108.8 | 114.3 | 71.7 | 71.3 | |
| 22 | DF | Corridor NE | | | | 47.9 | 45 | |
| 22 | DF | Corridor NW | | | | 61.1 | 45.8 | |
| 22 | DF | Corridor SW | | | | 58.1 | 44.8 | |
| 22 | DF | Corridor SE | | | | 66.9 | 47.4 | |
| 21 | S | Women's Rm. (Building Core) | 76.4 | 92.6 | 118.4 | 72.4 | 71.7 | |
| 21 | S | Men's Rm. (Building Core) | 98.4 | 104.3 | 112.3 | 76.4 | 70.1 | |
| 21 | DF | Corridor NE | | | | 65.3 | 45.5 | |
| 21 | DF | Corridor NW | | | | 61 | 44.5 | |
| 21 | DF | Corridor SW | | | | 64.6 | 46.1 | |
| 21 | DF | Corridor SE | | | | 63.5 | 46.9 | |
| 21 | S | 2195B | 69.9 | 63.3 | 111.9 | 70.4 | 69.3 | |
| 20 | S | Women's Rm. (Building Core) | 100.1 | 107.4 | 117.4 | 75.8 | 80 | |
| 20 | S | Men's Rm. (Building Core) | 78.7 | 104.4 | 121.4 | 73.8 | 72.1 | |
| 20 | DF | Corridor NW | | | | 61.8 | 54.8 | |

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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 20 | DF | Corridor NE | | | | 70.1 | 53.3 | |
| 20 | DF | Corridor SE | | | | 67.1 | 63.6 | |
| 20 | DF | Corridor SW | | | | 68.9 | 60.2 | |
| 20 | S | 2083I 1 | 69.3 | 70.1 | 121.8 | 70.3 | 69.9 | |
| 20 | SH | 2007B2 | 71.4 | 98.3 | 111.5 | 71.7 | 69.9 | |
| 19 | S | Women's Rm. (Building Core) | 76.3 | 108.6 | 111.4 | 81.6 | 83.5 | |
| 19 | S | Men's Rm. (Building Core) | 89.6 | 100.9 | 108.8 | 75.8 | 75.8 | |
| 19 | DF | Corridor NW | | | | 53.8 | 48.6 | |
| 19 | DF | Corridor NE | | | | 57.2 | 50 | |
| 19 | DF | Corridor SE | | | | 53.9 | 47.8 | |
| 19 | DF | Corridor SW | | | | 70.3 | 69.1 | |
| 18 | S | Women's Rm. (Building Core) | 102.4 | 106.6 | 107 | 79.4 | 76.2 | |
| 18 | S | Men's Rm. (Building Core) | 96.8 | 107.7 | 117.4 | 78.6 | 79.4 | |
| 18 | DF | Corridor NW | | | | 70.9 | 53.9 | |
| 18 | DF | Corridor NE | | | | 65.5 | 50.4 | |
| 18 | DF | Corridor SE | | | | 67.1 | 62.6 | |
| 18 | DF | Corridor SW | | | | 67.6 | 51.9 | |
| 17 | S | Women's Rm. (Building Core) | 98.1 | 107.4 | 115.3 | 79 | 80.6 | |
| 17 | S | Men's Rm. (Building Core) | 98.3 | 110.6 | 116.3 | 76.3 | 74.6 | |
| 17 | DF | Corridor NW | * | * | * | * | * | |
| 17 | DF | Corridor NE | | | | 52.9 | 48.1 | |
| 17 | DF | Corridor SE | | | | 69.8 | 48.8 | |
| 17 | DF | Corridor SW | | | | 62.4 | 48.9 | |
| 16 | T (T-1-3/4) | 1696 | | | | | | 75.1 |
| 16 | S | Women's Rm. 1642 (Building Core) | 77.9 | 85.2 | 99.3 | 74.1 | 73.5 | |
| 16 | S | Men's Rm. 1606 (Building Core) | 80.3 | 95.8 | 113.8 | 73.3 | 73.3 | |
| 16 | DF | Corridor SE | | | | 69.4 | 49.3 | |
| 16 | DF | Corridor SW | | | | 68.4 | 48.3 | |
| 16 | DF | Corridor NW | | | | 60.4 | 48.2 | |
| 16 | DF | Corridor NE | | | | 71 | 47.8 | |
| 16 | S | Women's Rm. 1671 (Building Core) | 69.6 | 79.6 | 117.5 | 69.6 | 69.9 | |

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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 16 | S | Men's Rm. 1673 (Building Core) | 71 | 80.8 | 108 | 71 | 70.4 | |
| 15 | AHU (A-7-47) | 1594 | | | | | | 53.4 |
| 15 | S | Women's Rm. 1542 (Building Core) | 89.9 | 98 | 109.6 | 79.7 | 76.8 | |
| 15 | S | Men's Rm. 1558 (Building Core) | 75.9 | 86.6 | 108.5 | 74.9 | 72.5 | |
| 15 | S | Women's Rm. 1598 (Building Core) | 90.8 | 87.3 | 107.9 | 92.8 | 73.5 | |
| 15 | S | Men's Rm. 1506 (Building Core) | 101.3 | 109.1 | 114.6 | 76.9 | 73.5 | |
| 15 | DF | Corridor NE | | | | 71.4 | 51 | |
| 15 | DF | Corridor NW | | | | 67.6 | 49.6 | |
| 15 | DF | Corridor SW | | | | 72.4 | 54.9 | |
| 15 | DF | Corridor SE | | | | 72.8 | 52.1 | |
| 14 | S | Women's Rm. 1442 (Building Core) | 92.5 | 101.5 | 118.1 | 83.6 | 82.1 | |
| 14 | S | Men's Rm. 1408 (Building Core) | 85.4 | 98.6 | 106.3 | 80.8 | 78.3 | |
| 14 | S | Women's Rm. 1471 (Building Core) | 85.4 | 88.7 | 106.9 | 74.6 | 72.7 | |
| 14 | S | Men's Rm. 1473 (Building Core) | 74.9 | 89 | 114.9 | 74.3 | 71.7 | |
| 14 | DF | Corridor NE | | | | 72.9 | 51.4 | |
| 14 | DF | Corridor NW | | | | 71.6 | 53.4 | |
| 14 | DF | Corridor SW | | | | 69.7 | 52.4 | |
| 14 | DF | Corridor SE | | | | 70.3 | 53.4 | |
| 13 | S | Men's Rm. 1308 (Building Core) | 82.8 | 90.4 | 109.2 | 88.1 | 74.6 | |
| 13 | S | Women's Rm. 1390 (Building Core) | 80.7 | 81.3 | 113.6 | 81 | 72.1 | |
| 13 | S | Men's Rm. 1354 (Building Core) | 79.9 | 91.6 | 113.1 | 76.6 | 71 | |
| 13 | S | Women's Rm. 1342 (Building Core) | 88.8 | 98.4 | 117.7 | 77.1 | 78.2 | |
| 13 | DF | Corridor SW | | | | 72 | 50.6 | |
| 13 | DF | Corridor SE | * | * | * | * | * | |
| 13 | DF | Corridor NE | | | | 71.6 | 49.8 | |
| 13 | DF | Corridor NW | | | | 63.1 | 49.2 | |
| 12 | S | Women's Rm. 1242 (Building Core) | 84.6 | 96.4 | 107.9 | 84.8 | 75.1 | |
| 12 | S | Men's Rm. 1206 (Building Core) | 79 | 117.9 | 111.4 | 77.2 | 74.3 | |
| 12 | S | Women's Rm. 1291 (Building Core) | 93.9 | 102.6 | 107.4 | 75.9 | 74.3 | |
| 12 | S | Men's Rm. 1287 (Building Core) | 79.3 | 97.3 | 108.4 | 75.9 | 74 | |
| 12 | DF | Corridor NE | | | | 72.9 | 39.4 | |

**Temperatures at Domestic Water Sources**
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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 12 | DF | Corridor NW | | | | 71.9 | 39.4 | |
| 12 | DF | Corridor SW | | | | 69.1 | 39.4 | |
| 12 | DF | Corridor SE | | | | 67.3 | 39.3 | |
| 12 | S | 1259 | 75.9 | 78.9 | 109.5 | 77.6 | 75.2 | |
| 11 | S | Women's Rm. 1198 (Building Core) | 89.9 | 103.4 | 109.8 | 78.3 | 74.4 | |
| 11 | S | Men's Rm. 1106 (Building Core) | 77.4 | 100.7 | 110.1 | 81.8 | 74.4 | |
| 11 | S | Women's Rm. 1152 (Building Core) | 103.4 | 105.7 | 107.4 | 77.4 | 74.5 | |
| 11 | S | Men's Rm. 1142 (Building Core) | 81.7 | 87.6 | 100.1 | 77.2 | 73.6 | |
| 11 | DF | Corridor SW | | | | 63.8 | 40.9 | |
| 11 | DF | Corridor SE | | | | 70.3 | 39.4 | |
| 11 | DF | Corridor NE | | | | 55.3 | 39.6 | |
| 11 | DF | Corridor NW | | | | 70.3 | 40.5 | |
| 10 | S | Women's Rm. 1042 (Building Core) | 90.8 | 95.1 | 101.5 | 77 | 74.4 | |
| 10 | S | Men's Rm. 1052 (Building Core) | 87.2 | 102.2 | 107.7 | 75.1 | 74.2 | |
| 10 | S | Women's Rm. 1098 (Building Core) | 83.06 | 102.3 | 109.7 | 82.5 | 74.1 | |
| 10 | S | Men's Rm. 1006 (Building Core) | 78.9 | 96.4 | 108 | 80 | 73.7 | |
| 10 | DF | Corridor SE | | | | 69.9 | 40.3 | |
| 10 | DF | Corridor SW | | | | 68.6 | 38.8 | |
| 10 | DF | Corridor NW | | | | 65.5 | 42.1 | |
| 10 | DF | Corridor NE | | | | 65.8 | 42.3 | |
| 9 | S | Men's Rm. 952 (Building Core) | 75.3 | 97.7 | 107.4 | 78.6 | 74.1 | |
| 9 | S | Women's Rm. 942 (Building Core) | 79.3 | 87.7 | 98.6 | 81.6 | 72.9 | |
| 9 | S | Men's Rm. 906 (Building Core) | 72.6 | 94..4 | 102.6 | 74 | 72.5 | |
| 9 | S | Women's Rm. 998 (Building Core) | 81 | 96.3 | 103.1 | 73.5 | 72.1 | |
| 9 | DF | Corridor NE | | | | 66.9 | 41.4 | |
| 9 | DF | Corridor NW | | | | 71.3 | 39.5 | |
| 9 | DF | Corridor SW | | | | 70.7 | 39.1 | |
| 9 | DF | Corridor SE | | | | 69.7 | 40.9 | |
| 8 | S | Men's Rm. 806 (Building Core) | 87.2 | 99..1 | 102.9 | 74 | 73.1 | |
| 8 | S | Women's Rm.898 (Building Core) | 92.4 | 98.9 | 104.3 | 75.2 | 72.8 | |
| 8 | S | Men's Rm. 842 (Building Core) | 79.7 | 87.6 | 92.8 | 75.1 | 73.5 | |

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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 8 | S | Women's Rm. 852 (Building Core) | 88.6 | 102.9 | 106.4 | 77 | 73.8 | |
| 8 | DF | Corridor SW | | | | 67.6 | 40.4 | |
| 8 | DF | Corridor SE | | | | 68.4 | 41.3 | |
| 8 | DF | 869 | | | | 65.9 | 39.9 | |
| 8 | S | 839 | 94.6 | 101.3 | 109.9 | 79 | 70.3 | |
| 7 | S | Women's Rm. 742 (Building Core) | 75.4 | 75.5 | 77.6 | 75.2 | 74.2 | |
| 7 | S | Men's Rm. 752 (Building Core) | 82.4 | 102.9 | 106.5 | 76.2 | 74.9 | |
| 7 | S | Women's Rm. 798 (Building Core) | 80.4 | 99.3 | 102.2 | 73.9 | 73.1 | |
| 7 | S | Men's Rm. 706 (Building Core) | 108.7 | 102.4 | 102.5 | 74.9 | 72.8 | |
| 7 | DF | Corridor SE | | | | 47.4 | 40.8 | |
| 7 | DF | Corridor SW | | | | 73.5 | 41.6 | |
| 7 | DF | Corridor NW | | | | 66.5 | 41.6 | |
| 7 | DF | Corridor NE | | | | 70.7 | 41.8 | |
| 7 | S | 741 | 73.4 | 71.9 | 110.3 | 78.4 | 73.9 | |
| 7 | S | Kitchenette 769 | 81.5 | 93.4 | 110.8 | 78.5 | 71.1 | |
| 7 | S | 711C | 76.6 | 82.5 | 109.1 | 73.5 | 69.1 | |
| 6 | S | Women's Rm. 642 (Building Core) | 74.8 | 75.9 | 81.8 | 74.5 | 73.6 | |
| 6 | S | Men's Rm. 652 (Building Core) | 97.9 | 102.4 | 105.6 | 74 | 73.3 | |
| 6 | S | Women's Rm. 698 (Building Core) | 89 | 96.9 | 99.6 | 75.9 | 73.1 | |
| 6 | S | Men's Rm. 606 (Building Core) | 86 | 90.6 | 102.9 | 74.9 | 73.1 | |
| 6 | DF | Corridor SE | | | | 69.2 | 40.9 | |
| 6 | DF | Corridor SW | | | | 61.3 | 41.4 | |
| 6 | DF | Corridor NW | | | | 71.7 | 41.2 | |
| 6 | DF | Corridor NE | | | | 51.6 | 42 | |
| 5 | S | Women's Rm. 542 (Building Core) | 73.9 | 78 | 90.6 | 73.7 | 73.3 | |
| 5 | S | Men's Rm. 552 (Building Core) | 76.1 | 103.8 | 107.8 | 74.5 | 73.5 | |
| 5 | S | Women's Rm. 598 (Building Core) | 89.6 | 100.9 | 102.3 | 76.5 | 73.1 | |
| 5 | S | Men's Rm. 506 (Building Core) | 77.6 | 102.1 | 102.8 | 74.8 | 73.4 | |
| 5 | DF | Corridor SE | | | | 48.4 | 41.6 | |
| 5 | DF | Corridor SW | | | | 43.8 | 40.6 | |
| 5 | DF | Corridor NW | | | | 50.2 | 41.2 | |

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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 5 | DF | Corridor NE | | | | 69.8 | 41.2 | |
| 4 | S | Women's Rm. 498 (Building Core) | 77.6 | 102.1 | 106.1 | 76.5 | 73.4 | |
| 4 | S | Men's Rm. 406 (Building Core) | 84.9 | 102.9 | 105.1 | 74.8 | 72.9 | |
| 4 | S | Women's Rm. 442 (Building Core) | 73.4 | 73.6 | 73.1 | 73.1 | 72.5 | |
| 4 | S | Men's Rm. 452 (Building Core) | 83.1 | 103.4 | 104.4 | 73.7 | 72.3 | |
| 4 | DF | Corridor NW | | | | 71.1 | 39.3 | |
| 4 | DF | Corridor NE | | | | 71.4 | 39.9 | |
| 4 | DF | Corridor SE | | | | 62.1 | 39.4 | |
| 4 | DF | Corridor SW | | | | 67.3 | 39.5 | |
| 3 | S | Women's Rm. 342 (Building Core) | 74.2 | 75.8 | 104.2 | 74.2 | 73.9 | |
| 3 | S | Men's Rm. 352 (Building Core) | 74.1 | 79.9 | 106 | 73.8 | 75.8 | |
| 3 | S | Women's Rm. 304 (Building Core) | 93.2 | 101.1 | 112.2 | 75.3 | 72.4 | |
| 3 | S | Men's Rm. 306 (Building Core) | 77.6 | 85.9 | 105.7 | 74.6 | 75.3 | |
| 3 | DF | Corridor SE | | | | 71.3 | 40.5 | |
| 3 | DF | Corridor SW | | | | 71.1 | 40.4 | |
| 3 | DF | Corridor NW | | | | 69.4 | 39.9 | |
| 3 | DF | Corridor NE | | | | 72.3 | 41.9 | |
| 3 | S | 311 Staff Office | 77 | 78.4 | 104.3 | 78.3 | 73.6 | |
| 3 | S | 311 Kitchenette | 78.4 | 100.5 | 105.3 | 76.4 | 72.8 | |
| 3 | S | 311 Treatment Room 2 | 72.6 | 74.1 | 106 | 77.1 | 71.3 | |
| 3 | S | 311 Restroom Staff Only | 72.1 | 103.3 | 105.2 | 78.1 | 71.9 | |
| 2 | S | Women's Rm. 242 (Building Core) | 75.3 | 79.1 | 102.9 | 76.8 | 71.4 | |
| 2 | S | Men's Rm. 252 (Building Core) | 81.1 | 90 | 108.8 | 75.4 | 70.9 | |
| 2 | S | Women's Rm. 204 (Building Core) | 82.4 | 87.9 | 111.1 | 76.5 | 72.9 | |
| 2 | S | Men's Rm. 206 (Building Core) | 76.5 | 94.4 | 103.9 | 74.2 | 75.2 | |
| 2 | DF | Corridor SE | | | | 71.9 | 39.9 | |
| 2 | DF | Corridor SW | | | | 71.7 | 42 | |
| 2 | DF | Corridor NW | | | | 65.3 | 41.2 | |
| 2 | DF | Corridor NE | | | | 69.7 | 41.9 | |
| S. Mez. | S | DCK Office Kitchenette | 73.3 | 78.1 | 89.7 | 74.1 | 40.2 | |
| S. Mez. | S | M189 Men's | 88.4 | 91.1 | 107.1 | 73.6 | 70.3 | |

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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| 1 | DF | Corridor at 181 | | | | 63 | 43.6 | |
| 1 | DF | Corridor at 135 | | | | 72.6 | 42.2 | |
| 1 | DF | Corridor at Postal | | | | 69.7 | 43.3 | |
| 1 | S | 127A Toilet | 74.9 | 75.2 | 104.2 | 77.6 | 74.8 | |
| 1 | S | 125 Sink | 74.4 | 75.9 | 101.2 | 76.3 | 74.4 | |
| 1 | S | 181 Rest Room | 71.1 | 68.9 | 102.8 | 69.8 | 71 | |
| 1 | S | 181 A3 Rest Room | 80.7 | 98.8 | 109.1 | 79.9 | 73.7 | |
| 1 | S | Post Office Men's Rm | 73.3 | 73.6 | 100.1 | 74.6 | 72.3 | |
| B | S | Men's Rm.(near Dock) | 76.9 | 79.9 | 76.2 | 76.1 | 76.2 | |
| B | S | Men's Rm. (Kitchen) | 91.9 | 118.1 | 131.1 | 78.5 | 73.1 | |
| B | DF | Kitchen (built in cooler) | | | | 56.6 | 63.4 | |
| B | S | Handwash Sink (Kitchen) | 76.5 | 108.9 | 127.1 | 81.9 | 75.9 | |
| B | S | Women's Rm. (Kitchen) | 118.5 | 129.4 | 103.5 | 78.3 | 73.9 | |
| B | S | Sink #4 (Kitchen) | 81.1 | 118.1 | 127.4 | 85.2 | 72 | |
| B | S | Men's Rm. (At Cafeteria Elevators) | 74.5 | 72.4 | 81.8 | 71.4 | 73.7 | |
| B | S | Women's Rm. (At Cafeteria Elevators) | 74.5 | 75.1 | 80.7 | 74.5 | 72.7 | |
| B | S | B63 | 71.1 | 76.4 | 106.9 | 72 | 71 | |
| B | S | B73 | 90.6 | 101.4 | 112.6 | 71.4 | 70.1 | |
| B | S | B75 | 96.4 | 106 | 109.4 | 77.2 | 73.1 | |
| B | S | B77 | 82.7 | 74 | 114.1 | 72.4 | 72.5 | |
| SB | AHU (A-6-11) | SB-65F | | | | | | 66 |
| SB | AHU (A-11-1) | SB-64 | | | | | | 60.7 |
| SB | AHU (A-11-2) | SB-64 | | | | | | 53.7 |
| SB | AHU (A-11-3) | SB-64 | | | | | | 54 |
| SB | AHU (A-11-6) | SB-38 | | | | | | 56.8 |
| SB | AHU (A-11-7) | SB-38 | | | | | | 54.6 |
| SB | AHU (A-11-8) | SB-68 | | | | | | 51.3 |
| SB | DWF (W-1-1) | SB-38 | | | | | | 40 |
| SB | SH | Women's Rm. (Exercise Room) | 67.9 | 97.7 | 105.3 | 68.9 | 70.1 | |
| SB | SH | Men's Rm. (Exercise Room) | 73.7 | 95 | 104 | 71.4 | 70.8 | |

**Temperatures at Domestic Water Sources**
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| Floor | Fixture/Equipment | Room | HW/FD | HW/MID | HW/EQ | CW/FD | CW/EQ | RES TEMP |
|---|---|---|---|---|---|---|---|---|
| SB | DF | SB-38 | | | | 72.3 | 38.8 | |
| SB | S | H.S. Men's Rm. | 73.4 | 96.4 | 109.1 | 77.4 | 73.6 | |
| SB | S | SB-62 Men's Rm. | 98.4 | 108.8 | 110.3 | 79.1 | 74.8 | |

All temperatures in degrees Fahrenheit (ºF)

**Abbreviations:**

S - Sink
SH - Shower
DF - Drinking Fountain
HE - Heat Exchanger
DWF - Drinking Water Filtration Unit
CT - Cooling Tower
T - Tank
AHU - Air Handling Unit (temperature of standing water in drip pan)

CW - Cold Water
HW - Hot Water
FD - First Draw
MID - Midpoint (20 seconds after first draw)
EQ - Equilibrium Temperature
RES TEMP - Temperature of equipment with water reservoir
* - Out of Service

Note: Mixing valve issues may have allowed hot water infiltration during cold water temperature evaluation